PATENT
Attorney Docket No. 401452/Takada

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

AOYAGI et al.

Application No.	Unassigned	Art Unit:	Unassigned
Filed:	November 14, 2001	Examiner:	Unassigned
For:	SEMICONDUCTOR LASER DEVICE		

PENDING CLAIMS AFTER ENTRY OF PRELIMINARY AMENDMENT

1. A semiconductor laser device comprising:

a semiconductor substrate of a first conductivity type;

a first cladding layer of the first conductivity type disposed on the semiconductor substrate;

an active layer disposed on the first cladding layer and having uniformly flat upper and lower boundary surfaces in an optical waveguide direction;

a second cladding layer of a second conductivity type disposed on the active layer; and

a diffraction grating layer having a phase-shifted structure in the optical waveguide direction, between the active layer and one of the first and second cladding layers, wherein

the diffraction grating layer has a length in the optical waveguide direction $L \leq 260$ μm;

a mean coupling factor κ of a diffraction grating layer is $\kappa \geq 150$ cm^{-1}; and

κL satisfies $5.6 > \kappa L > 3.0$.

2. The semiconductor laser device according to claim 1, wherein power threshold gain αth per unit length in a principal axial mode satisfies 7 $cm^{-1} \leq \alpha th \leq 51$ cm^{-1}.

3. The semiconductor laser device according to claim 1, further comprising a heavily-doped p-type region having a carrier concentration of 10^{18} cm^{-3} in at least a portion of a p-type layer proximate at least a portion of the active layer.

4. The semiconductor laser device according to claim 2, further comprising a heavily-doped p-type region having a carrier concentration of 10^{18} cm^{-3} in at least a portion of a p-type layer proximate at least a portion of the active layer.

5. The semiconductor laser device according to claim 1, wherein

$\lambda p - 100 \leq \lambda g \leq \lambda p + 100$,

where a composition wavelength of the diffraction grating layer is λg (nm) and an oscillation wavelength is λp (nm).

6. The semiconductor laser device according to claim 2, wherein

$\lambda p - 100 \leq \lambda g \leq \lambda p + 100$,

where a composition wavelength of the diffraction grating layer is λg (nm) and an oscillation wavelength is λp (nm).

7. The semiconductor laser device according to claim 3, wherein

$\lambda p - 100 \leq \lambda g \leq \lambda p + 100$,

where a composition wavelength of the diffraction grating layer is λg (nm) and an oscillation wavelength is λp (nm).

8. The semiconductor laser device according to claim 4, wherein

$\lambda p - 100 \leq \lambda g \leq \lambda p + 100$,

where a composition wavelength of the diffraction grating layer is λg (nm) and an oscillation wavelength is λp (nm).

9. The semiconductor laser device according to claim 1, wherein a highly-refractive portion of the diffraction grating layer has a length longer than that of a low-refractive portion of the diffraction grating layer in the optical waveguide direction.

10. The semiconductor laser device according to claim 2, wherein a highly-refractive portion of the diffraction grating layer has a length longer than that of a low-refractive portion of the diffraction grating layer in the optical waveguide direction.

11. The semiconductor laser device according to claim 3, wherein a highly-refractive portion of the diffraction grating layer has a length longer than that of a low-refractive portion of the diffraction grating layer in the optical waveguide direction.

12. The semiconductor laser device according to claim 4, wherein a highly-refractive portion of the diffraction grating layer has a length longer than that of a low-refractive portion of the diffraction grating layer in the optical waveguide direction.

13. The semiconductor laser device according to claim 5, wherein a highly-refractive portion of the diffraction grating layer has a length longer than that of a low-refractive portion of the diffraction grating layer in the optical waveguide direction.

14. The semiconductor laser device according to claim 6, wherein a highly-refractive portion of the diffraction grating layer has a length longer than that of a low-refractive portion of the diffraction grating layer in the optical waveguide direction.

15. The semiconductor laser device according to claim 7, wherein a highly-refractive portion of the diffraction grating layer has a length longer than that of a low-refractive portion of the diffraction grating layer in the optical waveguide direction.

16. The semiconductor laser device according to claim 8, wherein a highly-refractive portion of the diffraction grating layer has a length longer than that of a low-refractive portion of the diffraction grating layer in the optical waveguide direction.